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HAROLD MOWRY, Director
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Soil Fumigation for Cigar-Wrapper Tobacco Fields

By RANDALL R. KINCAID and GAYLORD M. VOLK

Plant Pathologist, North Florida Experiment Station, Quincy, and Soils Chemist, Main Station, Gainesville

Soil fumigation has been rapidly accepted by growers of cigar-wrapper (shade) tobacco, to the extent of about three-fourths of the acreage of the 1948 crop. This paper offers suggestions for the most effective use of fumigation, based on experimental work and general observations to date.

The fumigation process is begun by injecting a liquid fumigant into the soil about six inches deep at intervals of 12 inches. The liquid evaporates and the gas spreads through the soil in every direction, killing nematodes and certain other organisms present. The gas gradually escapes from the soil. The odor can be detected for a few days. After about two weeks the maximum effect of the gas has taken place and the soil can be cultivated to hasten the disappearance of the residue of the fumigant.

Two different types of fumigant are used. One type, sold as D-D or Dowfume N, is dark in color. The other, sold as Dowfume W-40 or Soilfume 60-40, is colorless. Commercial organizations are available to furnish and apply either or both types of fumigant. There are a few individually owned applicators in operation.

The choice of fumigant may prove to be dependent on factors such as type of soil, temperature and date of fumigation, but at present there is not enough information to make specific recommendations.

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The rate of fumigation per acre is 20 gallons of D-D or Dowfume N or 15 gallons of Dowfume W-40 or Soilfume 60-40. These rates appear at present to be generally satisfactory. The cost of treatment with the two types of fumigant is approximately the same.

The date of fumigation most convenient to the tobacco program falls between November 15 and February 15, that is, after the shade has been harrowed and the plant residues are fairly well decayed, and before it is time to apply commercial fertilizer for the next crop. Stable manure may be applied before fumigation if it is not so trashy as to interfere with fumigation.

Fumigation in late September, followed after a period of at least two weeks by a cover crop of oats, has been tried on a small acreage and appears promising. This might be tried on shades where there is no worth while cover crop growing on the first of September.

Preparation of the soil is an important consideration. The shade should be thoroughly cultivated to a depth of eight inches. The soil should be comparatively free of clods, because they cannot be effectively fumigated, and of trash which might clog the applicator or cause the gas to escape too rapidly from the soil.

Soil moisture should be suitable for planting a crop. The shade should not be fumigated when the soil is extremely dry or, of course, when too wet for cultivation. Light rain following fumigation is favorable because water helps to hold the gas in the soil. Heavy rain delays the movement of gas through the soil and its disappearance from the soil, but this does not appear very objectionable under shade conditions.

Temperature should be within reasonable limits. Fumigation should not be attempted in extremely cold weather, never if the ground is frozen. The temperature is not likely to be too high in winter but might prove to be a limiting factor in the September fumigation mentioned above.

The direction of fumigation is generally most satisfactory across the tobacco rows, because this minimizes the result of any defect in application, especially in maintaining the 12-inch spacing in the post rows. Satisfactory fumigation with the rows is possible but requires careful operation. **The last harrowing before fumigation** should be done at right angles or diagonally to the direction in which the applicator is to be run.

Dragging after fumigation should be done thoroughly to compact the soil in the applicator furrows, to fill holes, and to remove elevations which would not be well fumigated. If for any reason the drag attached to the applicator does not fulfill these requirements, it is considered advisable to follow with a straight, heavy drag at right angles or diagonally to the course of the applicator.

Terraces, which must be torn down before fumigation, should be rebuilt immediately afterward to control erosion.

An unfumigated section or part of a section should be left as a check in every shade. This is strongly urged on all growers, so that they may intelligently evaluate the results of fumigation under their own conditions, and avoid giving undue credit if the outcome is good or placing unwarranted blame if the outcome is not satisfactory. Unfumigated checks offer a much-needed opportunity for growers, fumigation operators and research workers to find answers to some of the numerous questions regarding soil fumigation.

Your fumigation operator will be glad to leave such an unfumigated check section, suitably the fourth section (or a portion) with the rows and nearest the most accessible gate to the shade. Growers of a large acreage would do well to try both types of fumigant under comparable conditions in the same shade, leaving a section between them unfumigated as a check.

The yield of tobacco has been markedly increased in most instances where comparative figures are available. The over-all increase in yield has evidently paid the cost of fumigation many times over.

The quality of tobacco produced with fumigation appears satisfactory in general. In comparative tests at this Station, there has been a small but rather consistent reduction in burn. While this does not now appear to be serious, the burn and other aspects of quality must be given much more study before a final answer to these problems can be given.

Nitrogen transformations in the soil are affected by fumigation. The change of nitrogen from the ammonia to the nitrate form is delayed for several weeks, extending into the growing season in the field. This delay has the effect of conserving nitrogen ordinarily lost as nitrate by leaching during the early part of the season. It also has the effect of increasing the amount of nitrogen, especially in the form of ammonia, available to the crop

from a given application of fertilizer. When the effects of these factors have been sufficiently studied, it appears likely that some changes in fertilizer practice will be indicated. The effects of fumigation on the ammonia level in the soil and consequently on the plant are entirely separate and apart from the control of nematodes, and should be differentiated for a proper understanding of fumigation.

Root-knot has been satisfactorily controlled in most fumigation tests. Effectiveness is probably related to conditions prevailing at the time of fumigation, as already discussed.

Coarse root, the nematode root rot disease of tobacco, has not been as satisfactorily controlled by fumigation as has root-knot.

Blackshank.—There is no conclusive evidence that fumigation has any direct effect on blackshank. It is to be expected, however, that with consecutive crops of tobacco the disease will increase, sometimes to the point of causing moderate loss, especially on heavy soils and during dry seasons.

The frequency of fumigation to be suggested has not been determined. The carry-over effect of fumigation to the second tobacco crop was fair in one instance, not noticeable in another. Shades fumigated for the second successive year have given good results. It now appears that in some shades the increase in blackshank will limit the number of crops which should be grown in succession.